## PEER REVIEW HISTORY



## ARTICLE DETAILS

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| **TITLE (PROVISIONAL)** | Caesarean section provision and readiness in Tanzania: analysis of cross-sectional surveys of women and health facilities over time |
| **AUTHORS** | Cavallaro, Francesca L; Pembe, Andrea Barnabas; Campbell, Oona; Hanson, Claudia; Tripathi, Vandana; Wong, Kerry Lai Man; Radovich, Emma; Benova, Lenka |

## VERSION 1 – REVIEW

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| **REVIEWER** | Hannah Leslie<br>Harvard TH Chan School of Public Health |
| **REVIEW RETURNED** | 02-Jun-2018 |

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| **GENERAL COMMENTS** | Please find below suggestions for clarifying and strengthening this work.<br><br>• The methods section refers to 95% confidence intervals, but results are presented without indication of range or uncertainty with the exception of the IQR for volume and rate and the confidence interval in the line graph. Uncertainty estimates around the main results or explicit discussion of sources of uncertainty and reasons such estimates can not be calculated would strengthen the inference from this work. Recent work in effective coverage has used the delta method or the direct method for calculating variance of a product to generate confidence intervals around effective coverage estimates; in the case of high sampling fractions as may be the case in the SPA hospitals, the DHS program recommends using the finite sample correction.<br>• Were SPA sampling weights applied directly? The weights as provided are calculated to provide representative estimates across strata, specifically to account for the relative oversampling of hospitals, so using the original weights after limiting to caesarean section-capable facilities may not make sense. At the least the weights should be rescaled so that weighted and unweighted sample sizes match; it is unclear if this occurred in the current analysis.<br>• Decision-making around readiness indicators could be elaborated slightly more. For instance, the authors use running water on the delivery ward as a proxy for running water near caesarean sections, but do not use newborn bag and mask from delivery ward or infection control measures from either surgical area or delivery ward. Does this reflect concern over differences between the 2006 and 2015 SPA, concern that these indicators would not reflect the caesarean section area, or other issues specific to the context? Given that over half of facilities do not have stand alone theaters, an argument could be made for considering these indicators at least in terms of general readiness if not incorporating them into the 3-item summary. |

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| | • Definition of electricity – I was curious that authors did not include the item on frequency of outages asked in SPA, as this would help to validate that having a reliable source of electricity actually translates into reliable power supply.<br>• Presentation of results: it would be very helpful to have a Table 1 (or Supplemental table) and/or brief text summarizing the samples used to provide the number sampled (women / facilities) and response rates. It might also be helpful to report if the total number of facilities or total delivery facilities increased from 2006 to 2015 as context for the reported increase in facilities capable of providing caesarean sections.<br>• Table 1 indicates that the proportion of caesarean sections in public facilities declined dramatically from the 1990s to 2015, but this is discussed only obliquely in the text, perhaps due to the sizable role of FBO facilities and the incomplete information on FBO facilities from 2006. I concur that the distinction between FBO and private is meaningful, but would suggest presenting this breakdown clearly for 2015 data and discussing the rising proportion of facilities outside of public hospitals. This information can be noted in the discussion of the facility caesarean section rate.<br><br>Minor clarifications<br>• The column header 'total number of facilities in Tanzania' in Table 2 should be revised or annotated to indicate it is limited to hospitals and health centers (excluding tiers that do not offer caesarean sections: dispensaries and clinics) so that it is not misunderstood to be all / most facilities in Tanzania.<br>• The caesarean rate within facilities is not fully defined, and can be hard to follow based on the table provided. Are the tables showing total deliveries per month (vaginal deliveries per month from SPA + [caesarean sections over 3 months / 3]), caesarean sections per month, and caesarean section rate as a % of births? It's difficult to interpret in light of the footnote and the fact that the medians presented don't divide to produce the rate as provided. Assuming this is what is shown, consider removing to expanding the footnote to define what was calculated here relative to what was asked on SPA, add % to the rate column.<br>• Table 4 last column is a bit confusing, a note to explain what happened to the 2 facilities not in this column would be helpful.<br>• Map – consider different colors (or the same color range for both maps) than red / green, as viewers may at a glance interpret darkest red/pink as worst and darkest green as best. |

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| **REVIEWER** | Deogratius Bintabara<br>Department of Public Health, College of Health Sciences, The University of Dodoma, Dodoma, Tanzania |
| **REVIEW RETURNED** | 03-Jun-2018 |

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| **GENERAL COMMENTS** | Abstract<br>Page 2, Last sentence of conclusion "Efforts should ……" I think the recommendation should base on the weakness identified rather than the number of caesarean sections performed by these facilities.<br><br>Strengths and limitations of this study<br>The first sentence of bullet one even though it is good but seems not fit in strengths and I would recommend removing it. Just start with "This is the first<br>……"<br>Background |

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| | Page 3, 4th Paragraph, the first sentence, I would be very careful with making these statements, I think DHS performs this kind of assessment.<br><br>Method<br>Page 3, Data source, the second sentence "The DHS are nationally representative surveys of women ……." I believe these surveys are not only for women but involved multiple questionnaires. One of it is individual questionnaires in which all women between 25-49 years in the selected households are eligible but sub-sample of men in those households are also interviewed. I would recommend for a minor tweak in this sentence.<br><br>Page 4, Definitions and data quality checks, 1st paragraph, for non-public sector PFP and FBO have been disintegrated in 2014-2015 TSPA, why not for 2006? Is there any reason for doing that in 2014-2015 dataset only?<br><br>3rd paragraph, the exclusion of facilities based on the number of normal delivery less than 10 and low rate (1%) seems arbitrary. Considered implausibly low, without supporting reference or details about their effect during analysis will raise concerns to the readers.<br><br>I agree with the three indicators of assessing the readiness of facility to perform C-section, but missing the important components such as newborns resuscitations and preparedness for safe blood transfusion (ability to perform blood grouping and crossmatching, blood supply sufficiency and safety) it underscores the initiatives of this good work. All these variable are available in the SPA dataset but I do not understand why the authors did not consider them.<br><br>Page 5, Readiness of facilities performing caesareans in 2014-2015: 1st paragraph, last sentence “Facilities with missing data ……were excluded …” How many? What about the distribution of their baseline characteristics? Were similar or different from those included? Furthermore, can sampling and selection of the facilities be further clarified for easy to follow up the analysis you performed?<br><br>The last paragraph in this subsection, the type of weighting need to be explained clearly because I see the frequency and percentages are unweighted [for example number of all health centers 379 this is unweighted, the weighted is 129], you can confirm this even in the TSPA final report.<br><br>The methods section is underdeveloped as it does not give any information on how data was managed. Would be important to answer some questions like: How was the SPA and DHS linked? There are several approaches of linkage, which one has been used to link these datasets? What was the unit of analysis?<br><br>Results<br>Page 5, Trend in facilities performing caesareans over time: the authors presented results difficult to get them in the datasets. For example, in 2014-2015 Tanzania SPA, I believe there are 1188 unique facilities surveyed, of which 635 were Hospitals and Health centers, and only 271 reported performing C-sections. Please confirm the numbers also this can be checked in against Tanzania SPA final reports as well as prior studies.<br><br>Also, the discrepancy has been observed in table 2, the columns |

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| | indicating the total number of facilities in Tanzania and the estimated number of facilities providing C-sections in both 2006 and 2014-2015.<br><br>Since the dataset provided the actual number of facilities providing C-sections, I have concerned about the use of the estimated number. What was the rationale for this approach? What was the justification for not using the number available in the datasets?<br><br>Additionally, the last column show median number, I suggest providing their IQR for clear understanding the dispersion of that variable.<br><br>Page 6, Readiness of facilities performing caesareans in 2014-2015: also the percentages and numbers presented in the text and the corresponding Table 3 seems different from what I got, in the dataset, I see the number of hospitals is 256 and those providing delivery care 241, providing C-sections is 227 Please check for this.<br><br>On my side, the big issue is to know how many facilities in Tanzania are ready to perform C-sections. Maybe I overlooked but I did not see it<br><br>Discussion<br>The subheadings within the discussion seem not standards otherwise it conforms to the journal format.<br><br>It is odd that the discussion looks like results section. It would be good to avoid duplication/repetition of results in the discussion section. Furthermore, a summary sentence should be more concise at the beginning of the discussion.<br><br>In the Introduction, the authors intended to examine the provision and readiness of facility to perform C-section. However, only the provision has been presented in results and discussed in the discussion while readiness aspect which is the heart of this work it was not presented and discussed clearly in the current version.<br><br>Strengths and limitation<br>I see two sections; redundancy should be avoided otherwise it conforms to journal requirements.<br><br>Recommendations<br>This should be condensed and merged with the conclusion as it is redundant with some literature and results presented earlier.<br><br>Conclusion<br>I believe the authors intended to identify at what extent the Tanzanian health facilities are ready to perform the C-section as one of the important components of the CEmOC. However, with the current arguments, it becomes very difficult to reach the conclusion. |

**VERSION 1 – AUTHOR RESPONSE**

**Reviewer 1**: Thank you for the opportunity to review the manuscript, “Caesarean section provision and readiness in Tanzania: analysis of cross-sectional surveys of women and health facilities over time.” This work combines demographic and health system data to provide useful insights on

caesarean section in Tanzania. I found it well designed and compelling. Please find below suggestions for clarifying and strengthening this work.

*Thank you very much for taking the time to review this paper and for your helpful comments.*

- The methods section refers to 95% confidence intervals, but results are presented without indication of range or uncertainty with the exception of the IQR for volume and rate and the confidence interval in the line graph. Uncertainty estimates around the main results or explicit discussion of sources of uncertainty and reasons such estimates can not be calculated would strengthen the inference from this work. Recent work in effective coverage has used the delta method or the direct method for calculating variance of a product to generate confidence intervals around effective coverage estimates; in the case of high sampling fractions as may be the case in the SPA hospitals, the DHS program recommends using the finite sample correction.

*Thank you for this suggestion. We agree that confidence intervals are a useful addition to the results presented, and we have calculated 95% confidence intervals using the finite population correction, as suggested. These have been added to percentages presented in tables 2, 3, and 4.*

- Were SPA sampling weights applied directly? The weights as provided are calculated to provide representative estimates across strata, specifically to account for the relative oversampling of hospitals, so using the original weights after limiting to caesarean section-capable facilities may not make sense. At the least the weights should be rescaled so that weighted and unweighted sample sizes match; it is unclear if this occurred in the current analysis.

*The original SPA sampling weights were applied in our analysis, using the subpop option to restrict our analysis to facilities performing caesareans. We have performed a sensitivity analysis using rescaled weights for health centres and hospitals, calculated based on the proportion of all facilities performing caesareans in both facility levels.*

*We have included the sensitivity analysis in two additional supplementary tables (1a and 1b). The sensitivity analysis shows slightly lower facility readiness but does not meaningfully change our conclusions. We have also specified in the methods that the SPA weights were used and that original unweighted sample sizes are reported (p5).*

- Decision-making around readiness indicators could be elaborated slightly more. For instance, the authors use running water on the delivery ward as a proxy for running water near caesarean sections, but do not use newborn bag and mask from delivery ward or infection control measures from either surgical area or delivery ward. Does this reflect concern over differences between the 2006 and 2015 SPA, concern that these indicators would not reflect the caesarean section area, or other issues specific to the context? Given that over half of facilities do not have stand alone theaters, an argument could be made for considering these indicators at least in terms of general readiness if not incorporating them into the 3-item summary.

*Thank you for this comment. We used a proxy for running water because this indicator was not collected for the surgical theatre specifically. This indicator relates to infrastructure, and we believe that it is highly unlikely for a facility to ensure running water facilities are available on the delivery ward but not the surgical theatre.*

*However, we feel the same assumption could not be made for equipment items, which are more easily moved. Moreover, as noted, the SPA collect information on minor surgery, but unfortunately not general surgery. Minor surgery is defined as outpatient procedures, which usually last less than one hour and are performed under local anaesthesia. Most facilities in the SPA including dispensaries report performing minor surgery, so it would not be appropriate to assume that equipment available for minor surgeries reflect equipment in the theatre where caesarean sections are performed.*

*We have added a sentence to the methods to indicate that we did not use proxies for equipment (p4).*

• Definition of electricity – I was curious that authors did not include the item on frequency of outages asked in SPA, as this would help to validate that having a reliable source of electricity actually translates into reliable power supply.

*Thank you for pointing this out, this was an omission on our part. The item on frequency of outages was indeed included for facilities connected to the national grid (power outages were not asked for other sources of supply).*

*This has now been specified in the relevant sentence in the methods (p4).*

• Presentation of results: it would be very helpful to have a Table 1 (or Supplemental table) and/or brief text summarizing the samples used to provide the number sampled (women / facilities) and response rates. It might also be helpful to report if the total number of facilities or total delivery facilities increased from 2006 to 2015 as context for the reported increase in facilities capable of providing caesarean sections.

*Thank you for this suggestion. We have included response rates for DHS and SPA in the Data sources section in the methods, as well as the total number of sampled facilities in each SPA (p4). Wehave also added the total number of live births in the recall period (our total sample size) in table 1, and at the start of the results section (p6).*

*A sentence was further added to the results section commenting on the increase in total number of facilities between the two SPAs (p6).*

• Table 1 indicates that the proportion of caesarean sections in public facilities declined dramatically from the 1990s to 2015, but this is discussed only obliquely in the text, perhaps due to the sizable role of FBO facilities and the incomplete information on FBO facilities from 2006. I concur that the distinction between FBO and private is meaningful, but would suggest presenting this breakdown clearly for 2015 data and discussing the rising proportion of facilities outside of public hospitals. This information can be noted in the discussion of the facility caesarean section rate.

*Indeed, the proportion of caesareans performed in public facilities declined over the last two decades, with most non-public sector caesareans occurring in FBO facilities (hospitals) rather than private-for-profit facilities. We believe the SPA reports of facility sector are more reliable than women's recall, although there was good agreement between women and facility reports when we checked.*

*We agree that these trends deserve to be commented on. We have noted the decrease in the percentage of caesareans conducted in the public sector at the end of the "Trends in caesareans over time" results section (p6), and additionally noted in the discussion that FBO hospitals account for the majority of non-public caesareans (p8).*

Minor clarifications:

• The column header 'total number of facilities in Tanzania' in Table 2 should be revised or annotated to indicate it is limited to hospitals and health centers (excluding tiers that do not offer caesarean sections: dispensaries and clinics) so that it is not misunderstood to be all / most facilities in Tanzania.

*Thank you for this comment. We have added a note to table 2.*

• The caesarean rate within facilities is not fully defined, and can be hard to follow based on the table provided. Are the tables showing total deliveries per month (vaginal deliveries per month from SPA + [caesarean sections over 3 months / 3]), caesarean sections per month, and caesarean section rate as a % of births? It's difficult to interpret in light of the footnote and the fact that the medians presented don't divide to produce the rate as provided. Assuming this is what is shown, consider removing to expanding the footnote to define what was calculated here relative to what was asked on SPA, add % to the rate column.

*We have amended column headings for tables 2 and 3, and added "%" to the caesarean rate column. For the sake of clarity, we have removed the footnote from table 3 (the method for calculating number of deliveries is described fully in the methods section).*

- Table 4 last column is a bit confusing, a note to explain what happened to the 2 facilities not in this column would be helpful.

*We have added a footnote to table 4 explaining that two facilities were excluded due to missing caesarean volume data.*

- Map – consider different colors (or the same color range for both maps) than red / green, as viewers may at a glance interpret darkest red/pink as worst and darkest green as best.

*Thank you for this point, we agree that it may lead to confusion. We have changed the map colour.*

**Reviewer 2:** Thank you for the opportunity to review the manuscript, "Caesarean section provision and readiness in Tanzania." I wish to congratulate the authors on their work. This work addresses an important question on the current quality of care delivered to women in Tanzania and draws on a rich dataset to do so. I appreciate the authors' effort to pool and link health facility data and population data in building up the research hypothesis. However, I have some slight concerns that authors may wish for amendments.

*Many thanks for taking the time to reviewour paper and for your helpful comments.*

Abstract:

Page 2, Last sentence of conclusion "Efforts should ……" PubMed ; I think the recommendation should base on the weakness identified rather than the number of caesarean sections performed by these facilities.

*Thank you for this comment. We have amended the abstract to specify efforts should focus on improving provision of anaesthesia in these facilities (p2).*

Strengths and limitations of this study:

The first sentence of bullet one even though it is good but seems not fit in strengths and I would recommend removing it. Just start with "This is the first……" PubMed ;

*We have removed the first sentence as suggested (p2).*

Background:

Page 3, 4th Paragraph, the first sentence, I would be very careful with making these statements, I think DHS performs this kind of assessment.

*Thank you for highlighting this lack of clarity on our part. The DHS does indeed describe the availability of caesarean section services in facilities, however it does not describe the equipment and infrastructure of facilities performing caesareans. We have amended the sentence accordingly to clarify ("To our knowledge, no studies have examined the equipment and infrastructure of facilities providing caesarean care at the national level in Tanzania […]", p3).*

Method:

Page 3, Data source, the second sentence "The DHS are nationally representative surveys of women ……." I believe these surveys are not only for women but involved multiple questionnaires. One of it is individual questionnaires in which all women between 25-49 years in the selected households are eligible but sub-sample of men in those households are also interviewed. I would recommend for a minor tweak in this sentence.

*Thank you for your comment. We agree that the DHS also includes a sample of men; however, for the sake of conciseness, we believe the sentence is clearer to readers without mentioning men, whose data are not used in this analysis.*

Page 4, Definitions and data quality checks, 1st paragraph, for non-public sector PFP and FBO have been disintegrated in 2014-2015 TSPA, why not for 2006? Is there any reason for doing that in 2014-2015 dataset only?

*Indeed, this information was not available in the 2006 dataset. The sentence has been edited to clarify (p4).*

3rd paragraph, the exclusion of facilities based on the number of normal delivery less than 10 and low rate (1%) seems arbitrary. Considered implausibly low, without supporting reference or details about their effect during analysis will raise concerns to the readers.

*Thank you for noting this. Both thresholds were determined in consultation with our Tanzanian obstetrician co-author, and apply to hospitals only. (Delivery volumes vary considerably more for lower-level facilities, and we were therefore unable to set corresponding thresholds for health centres.)*

*Private and particularly public hospitals in Tanzania tend to be large facilities, and usually above the median total delivery volume of 55 per month across health centres. We therefore think it is reasonable to use 10 vaginal deliveries per month as the lowest possible delivery volume for hospitals, and assume any lower volumes are likely to be data collection errors. Eight such hospitals were excluded from the median total delivery numbers and percentage of caesarean delivery calculations in table 3, but included in the analysis of readiness indicators.*

*The threshold of 1% caesarean rate for public hospitals was similarly an absolute minimum threshold for these facilities which receive obstetric referrals, with a higher corresponding complications caseload, and tend to have caesarean rates at or above the national caesarean rate level of 6%. The one public hospital with a recorded caesarean rate of less than 1% was excluded from volume analyses and from results weighted by caesarean volume (last column in table 4).*

*We have expanded the relevant sentence in the methods to clarify. "Hospitals with fewer than 10 recorded vaginal deliveries in the previous month were considered to have implausibly low delivery volume, and eight hospitals were excluded from the calculation of total delivery volume and caesarean rate as a result. If these volumes were, in fact, correct, reported results would overestimate the total delivery volume and underestimate the caesarean rate in hospitals. Similarly, caesarean rates below 1% in public hospitals were considered implausibly low, and one such hospital was excluded from the analyses on delivery volume." (p4)*

I agree with the three indicators of assessing the readiness of facility to perform C-section, but missing the important components such as newborns resuscitations and preparedness for safe blood transfusion (ability to perform blood grouping and crossmatching, blood supply sufficiency and safety) it underscores the initiatives of this good work. All these variable are available in the SPA dataset but I do not understand why the authors did not consider them.

*Thank you for highlighting this. We agree that neonatal resuscitation and safe blood transfusion are important indicators of safe caesarean care.*

*Indicators for neonatal resuscitation were not presented because the SPA collect this information from the delivery ward, but not the operating theatre itself. Since equipment items are easily moved, we believe it is not appropriate to use proxies for availability of bag and mask in theatre.*

*We examined several blood transfusion indicators to add to table 4, however many of them were difficult to interpret in light of different blood supply sources. The indicator for "running out of blood" is unclear for facilities relying on relatives' donations, and facility reports of infection screening may be inaccurate where blood is screened externally. After discussion with co-authors, we have changed the indicator from "refrigerator available" to "blood transfusion services available" in table 4 because we felt this was a more informative indicator.*

Page 5, Readiness of facilities performing caesareans in 2014-2015: 1st paragraph, last sentence "Facilities with missing data ……were excluded …" How many? What about the distribution of their baseline characteristics? Were similar or different from those included? Furthermore, can sampling and selection of the facilities be further clarified for easy to follow up the analysis you performed?

*We agree that missing data required more detail. The only readiness variable with missing data was running water on delivery ward, with 5% (predominantly private) facilities with missing data, which we have now excluded from this indicator only. We have added this information in the methods (p5).*

The last paragraph in this subsection, the type of weighting need to be explainedclearly because I see the frequency and percentages are unweighted [for example number of all health centers 379 this is unweighted, the weighted is 129], you can confirm this even in the TSPA final report.

*Thank you for this comment. Reported numbers are unweighted, while percentages are weighted. We have added this detail to the methods: "All analyses took into account SPA sampling weights in calculating percentages, as well as clusters and strata for 95% confidence intervals. Reported sample sizes are unweighted." (p5)*

*We consider that unweighted numbers provide more tangible information on facilities sampled for each facility type. Moreover, for hospitals the (larger) unweighted count better conveys the fact that enough hospitals were surveyed for meaningful inferences to be made.*

The methods section is underdeveloped as it does not give any information on how data was managed. Would be important to answer some questions like: How was the SPA and DHS linked? There are several approaches of linkage, which one has been used to link these datasets? What was the unit of analysis?

*Thank you for your feedback. Data from the SPA and DHS were not linked together for the analyses presented, and these data sources were analysed separately.*

Results:

Page 5, Trend in facilities performing caesareans over time: the authors presented results difficult to get them in the datasets. For example, in 2014-2015 Tanzania SPA, I believe there are 1188 unique facilities surveyed, of which 635 were Hospitals and Health centers, and only 271 reported performing C-sections. Please confirm the numbers also this can be checked in against Tanzania SPA final reports as well as prior studies.
Also, the discrepancy has been observed in table 2, the columns indicating the total number of facilities in Tanzania and the estimated number of facilities providing C-sections in both 2006 and 2014-2015.
Since the dataset provided the actual number of facilities providing C-sections, I have concerned about the use of the estimated number. What was the rationale for this approach? What was the justification for not using the number available in the datasets?

*Thank you for your comment. This section presents an approach to estimate the total number of facilities performing caesareans in Tanzania (rather than the number of facilities sampled in the SPAs). We use the percentage of hospitals and health centres performing caesareans obtained from the SPA, multiplied by the total number of such facilities in Tanzania, in order to calculate the expected number of facilities performing caesareans nationally. Our objective is to examine whether the absolute number of facilities performing caesareans increased over time.*

*We have edited footnote a of table 2 to further clarify: "Facility numbers were obtained from the survey sampling frames, rather than the number of facilities surveyed in the SPAs"*

Additionally, the last column show median number, I suggest providing their IQR for clear understanding the dispersion of that variable.

*The last two columns of table 2 present the ratio change for two measures between 2006 and 2014-15 (e.g. the ratio of 1.4 indicates the median monthly caesarean volume increased by 40% over this period among hospitals and health centres of all sectors).*

*We have bolded the headings and used thicker lines to make this clearer in table 2.*

Page 6, Readiness of facilities performing caesareans in 2014-2015: also the percentages and numbers presented in the text and the corresponding Table 3 seems different from what I got, in the dataset, I see the number of hospitals is 256 and those providing delivery care 241, providing C-sections is 227 Please check for this.

*Thank you for highlighting this discrepancy. The column heading should read "Total facilities", we have amended this. Our total sample size for hospitals differs slightly from the SPA (246 vs. 254 participating in the survey) because it excludes 8 public or parastatal specialist hospitals not providing delivery care, as specified in the methods ("Analysis" section, p5). We have added this information in a footnote to table 3.*

*We felt it made sense to exclude these specialist public referral facilities from the denominator since they intentionally do not provide delivery care based on their role in the health system, while all private or FBO hospitals could potentially offer delivery care.*

On my side, the big issue is to know how many facilities in Tanzania are ready toperform C-sections. Maybe I overlooked but I did not see it

*Thank you for this comment. Our objective was to examine three readiness criteria (consistent electricity, 24-hour providers, and general anaesthesia equipment) based on available data: as reported in table 4, 34% of all facilities performing caesareans meet the three presented readiness criteria.*

*We did not use this result to estimate the absolute number of facilities meeting these criteria, due to the multiple uncertainty sources (around the absolute number of facilities performing caesareans as well as the percentage meeting the three criteria).*

Discussion:

The subheadings within the discussion seem not standards otherwise it conforms to the journal format.
It is odd that the discussion looks like results section. It would be good to avoid duplication/repetition of results in the discussion section. Furthermore, a summary sentence should be more concise at the beginning of the discussion.

*Thank you for this comment. Considering the length of the discussion, we thought it would be helpful to signpost the different discussion sub-sections to the reader, and remind the reader of the key*

*findings at the start of the discussion. We would welcome any suggestionsfrom the editor regarding the structure of the discussion.*

In the Introduction, the authors intended to examine the provision and readiness of facility to perform C-section. However, only the provision has been presented in results and discussed in the discussion while readiness aspect which is the heart of this work it was not presented and discussed clearly in the current version.

*Thank you for highlighting this. As mentioned in response to a comment above, in this study we define readiness to perform caesareans as the availability of key infrastructure, staffing and equipment (based on the available indicators in the SPA) which are presented in table 4.*

Strengths and limitation:

I see two sections; redundancy should be avoided otherwise it conforms to journal requirements.

*We have removed "Unlike most SPAs" from the methods section (p5), edited one sentence, and deleted the last sentence from this section in order to minimise repetition (p8).*

Recommendations:

This should be condensed and merged with the conclusion as it is redundant with some literature and results presented earlier.

*Our study was a country-specific analysis, and we included the recommendations presented in this section in an attempt for our paper to be as useful as possible for policymakers and programme managers in Tanzania, after discussion with our Tanzanian clinician co-author. As mentioned above, we believe the discussion sub-headings are helpful to guide readers and highlight relevant sections, and we would welcome suggestions from the editor on this point.*

Conclusion:

I believe the authors intended to identify at what extent the Tanzanian health facilities are ready to perform the C-section as one of the important components of the CEmOC. However, with the current arguments, it becomes very difficult to reach the conclusion.

*Thank you for your comment. We have added "only one third of facilities meet the three readiness criteria" to the conclusion, in order to highlight the main finding on readiness in the conclusion (p10).*

**VERSION 2 – REVIEW**

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| **REVIEWER** | Hannah H. Leslie<br>Harvard TH Chan School of Public Health United States of America |
| **REVIEW RETURNED** | 30-Jul-2018 |

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| **GENERAL COMMENTS** | Thank you for your careful and thorough response to the reviews. I find the manuscript clear and compelling. My only suggestion would be to read through the methods one more time for clarity around the separate analysis of data sources since both reviewers initially thought some results reflected a combination of population with health system data. Perhaps an initial sentence under data sources laying out the parallel analysis of these secondary data would add |

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| | clarity; it would further be useful to qualify any sentences about methods to note the relevant dataset (for instance, 'all analyses [of facility data] took into account SPA sampling weights...') out of an abundance of caution.<br><br>As a question for future policy analysis, I do question if attempts to equip all health centers with c-section capacity provide the best way forward given the shortage of qualified health personnel noted in the Discussion section. Consideration of selective identification of centers to upgrade based on lack of access to hospitals might be a better use of limited resources. |

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| **REVIEWER** | Deogratius Bintabara<br>College of Health Sciences, The University of Dodom, Dodoma, Tanzania |
| **REVIEW RETURNED** | 27-Jul-2018 |

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| **GENERAL COMMENTS** | I congratulate the authors for taking their time to address many of my concerns. I agree with you to welcome suggestions from the editor on some points. I am wishing you all the best |

**VERSION 2 – AUTHOR RESPONSE**

Reviewer: 2
Reviewer Name: Deogratius Bintabara
Institution and Country: College of Health Sciences, The University of Dodoma, Dodoma, Tanzania
Please state any competing interests or state 'None declared': No declared

Please leave your comments for the authors below
I congratulate the authors for taking their time to address many of my concerns. I agree with you to welcome suggestions from the editor on some points. I am wishing you all the best

Response: Dear Deogratius, many thanks again for your considered feedback which has no doubt improved this paper.

Reviewer: 1
Reviewer Name: Hannah H. Leslie
Institution and Country: Harvard TH Chan School of Public Health, United States of America
Please state any competing interests or state 'None declared': None declared

Please leave your comments for the authors below
Dear Francesca and co-authors,

Thank you for your careful and thorough response to the reviews. I find the manuscript clear and compelling. My only suggestion would be to read through the methods one more time for clarity around the separate analysis of data sources since both reviewers initially thought some results reflected a combination of population with health system data. Perhaps an initial sentence under data sources laying out the parallel analysis of these secondary data would add clarity; it would further be useful to qualify any sentences about methods to note the relevant dataset (for instance, 'all analyses [of facility data] took into account SPA sampling weights...') out of an abundance of caution.

Response: Dear Hannah, many thanks for your feedback and for helping improve this paper. We agree with your suggestion to improve clarity in the methods section, and have added sentences

under the sections "Data sources" (p3) and "Analysis" (p5) which we hope make it clear to the reader that the DHS and SPA were analysed separately.

As a question for future policy analysis, I do question if attempts to equip all health centers with c-section capacity provide the best way forward given the shortage of qualified health personnel noted in the Discussion section. Consideration of selective identification of centers to upgrade based on lack of access to hospitals might be a better use of limited resources.

Response: Thank you for this point, we have added a sentence to the recommendations section in the discussion and re-structured the section accordingly.